

PATENT ABSTRACTS OF JAPAN

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(54) PAVEMENT MATERIAL AND MANUFACTURE THEREOF

(57)Abstract:

PURPOSE: To improve a function by adding and kneading a specific quantity of water to cement-mixed aggregate powder, which composition is specified, and curing kneaded material for a specific period.

CONSTITUTION: 0.5-10.0wt.% cement and 90.0-99.5wt.% aggregate powder containing not less than 50wt.% impalpable powder of 0.1mm or less are mixed. 20-40wt.% water is added and kneaded to the 100wt.% cement-mixed aggregate powder, thus manufacturing a pavement material 4. The pavement material 4 is cured for two or three days, shifted at least once or more to break up lumps, and the pavement material 4 is cured again. The pavement material 4 is used as a slope-face reinforcing material for a slag deposit-field rock embankment 5, a deposit-field soil sheathing embankment 6, etc. Accordingly, the outflow of the pavement material by rainwater can be prevented while the protective surface of the face of a slope can be constructed with sufficient strength, and the face of the slope can be trees-planted by the planting of garden trees.



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CLAIMS

[Claim(s)]

[Claim 1] cement 0.5 - 10.0wt% and 0.1mm the following impalpable powder -- more than 50wt% -- cement mixing aggregate powder 100 wt% which consists of aggregate powder [to contain] 90.0 - 99.5wt% -- receiving -- water -- 20 - 40wt% -- pavement material characterized by coming to contain.

[Claim 2] The manufacture approach of the pavement material characterized by side-****(ing) the pavement material according to claim 1 kneaded with the kneading machine once [at least] or more after care of health for two to three days, unfolding the lump of this pavement material, and making oneself recuperate again.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the pavement material which reinforcement and scour-proof nature are in the slope and park of a steep slope wall etc. of the remains of a quarry by the ability constructing, and can be planted in them, and its manufacture approach.

[0002]

[Description of the Prior Art] cement mixing aggregate 100wt % which generally becomes them from fine aggregate 30wt% and cement 10wt% coarse aggregate 60wt% in order to prevent the mudslide of falling stone or a slope in the end through steep slope wall of a road, or the steep slope wall of the remains of a quarry -- water -- 25wt(s)% -- the common cement concrete which makes one example what was added has been constructed.

[0003] Moreover, the pavement material which mixed ballast, sand, etc. with the petroleum system asphalt for pavement has been constructed by a location, an above-mentioned park, and an above-mentioned road. On the other hand, although the particle size distribution of soil is improved or many researches on the stabilization as the foundation of the soil by cement, lime, a bituminous material, etc. are also done, the subject of these researches is related with the various reinforcement of soil.

[0004] For example, a core is set to the stability of soil, such as what carried out addition mixing of cement and the water, and raised the reinforcement of the part to grain-refining soil like soil cement, and soil cement mixture which carried out addition mixing of comparatively a small amount of cement in soil, and aimed at the increment on the strength in soil.

[0005]

[Problem(s) to be Solved by the Invention] However, although the property excellent in water permeability-proof, scour-proof nature, reinforcement, etc. was shown when cement concrete was constructed to protection, such as a steep slope wall surface, there are no functions, such as permeability, water permeability, thermal conductivity, and revegetation nature, and there was a problem that the purpose could not fully be attained on environmental preservation and an accident prevention.

[0006] moreover, inadequate about reinforcement or scour-proof nature, although it has the property excellent in water permeability or revegetation nature when the soil set up so that the clay fraction of soil might be lessened and it might become the maximum consistency about the moisture content of soil is constructed in a steep slope wall etc. -- etc. -- the problem arose. It was very difficult for soil cement to pour cement milk into landfill or a base course, to raise the reinforcement, and to inject this cement milk into a steep slope wall surface etc. uniformly on the other hand, and since there was no revegetation nature even if it increased the reinforcement of this steep slope wall surface by moreover pouring in, it had the problem that the purpose of environmental preservation could not be attained.

[0007] This invention aims at offering the pavement material which is a material which also has the property of the soil which has the middle property of cement concrete and soil in reinforcement, and has permeability, water permeability, scour-proof nature, thermal conductivity, and revegetation nature, and its manufacture approach.

[0008]

[Means for Solving the Problem] this invention -- cement 0.5 - 10.0wt% and 0.1mm the following impalpable powder -- more than 50wt% -- cement mixing aggregate powder 100 wt% which consists of aggregate powder [to contain] 90.0 - 99.5wt% -- receiving -- water -- 20 - 40wt% -- it is the pavement material characterized by coming to contain. Moreover, it is the manufacture approach of the pavement material characterized by side-****(ing) the above-mentioned pavement material kneaded with the kneading machine once [at least] or more after care of health for two to three days, unfolding the lump of this pavement material, and making oneself recuperate again.

[0009]

[work --] for according to this invention -- cement 0.5 - 10.0wt% and 0.1mm As opposed to cement mixing aggregate powder 100 wt% which consists of aggregate powder [to contain] 90.0 - 99.5wt% the following impalpable powder -- more than 50wt% -- water -- 20 - 40wt% -- a fluidity by increase and addition of cement according to the thixotropy effectiveness by a lot of fines contained in this pavement material, since it is the contained pavement material Since reinforcement increases, the superfluous moisture more than the moisture which the hydration reaction of cement takes piles up between particles, a particle becomes gel on the other hand and suitable water permeability and plasticity are acquired when the hydration reaction of cement progresses, revegetation becomes possible.

[0010] The reason which limited the cement content to 0.5 - 10.0wt% is that the plasticity which can be planted will not be acquired less than [0.5 wt%] if a strength property is inadequate, is inferior to scour-proof nature and exceeds 10.0wt%. 0.1mm in aggregate powder The reason for having made the following impalpable powder more than 50wt% does not not much have a thing below this in a nature, and manufacturing artificially is because it is not economical.

[0011] cement mixing aggregate powder 100 wt% -- receiving -- water -- 20 - 40wt% -- the reason limited to containing is that revegetation nature and water permeability get worse and scour-proof nature gets worse [40wt% **] by the insufficiency of solidification less than [20wt%]. Although solidification of an ingredient can be prevented by side-****(ing) said pavement material kneaded with the kneading machine once [at least] or more after care of health for two to three days, unfolding the lump of this pavement material, and making oneself recuperate again In long-term age, a PORAZON reaction occurs in an ingredient and a precise insoluble hydrate generates on the particle front face of an ingredient. The increase of the bonding strength between particles, Since the reinforcement of an ingredient increases and crushing becomes difficult, it becomes possible by side-****(ing) pavement material once [at least] or more after care of health for two to three days, and unfolding a lump to prevent superfluous hardening of an ingredient.

[0012]

[Example] Below, the example of this invention is explained with reference to a table and a drawing. First, one example of this invention is described. As opposed to cement mixed ore slag 100 wt% which turns into 5wt(s)% from slag 95wt% as aggregate powder in Portland cement What kneaded 2t of contained roadbeds for 10 minutes with the eye RIHHI mixer is set to sample 1a of an example. water -- 28wt(s)% -- Portland cement with 10wt(s)% cement mixed ore slag 100 wt% which consists of slag 90wt% as aggregate powder -- receiving -- water -- 28wt(s)% -- what kneaded 2t of contained roadbeds for 10 minutes with the eye RIHHI mixer was set to sample 1b of an example.

[0013] in addition, the slag to which the slag used for this example refined the gold ore by all the mud cyaniding refining methods -- it is -- as the component -- SiO₂ about 85 wt(s)% -- a **** and its grain size -- 0.105mm the above - - 0.5% and 0.074mm - 0.105mm -- 5.9% and 0.074mm the following -- 93.6% it is . Moreover, granulated-blastfurnace-slag constituent cement 5wt% which consists of slaked-lime 1 wt% gypsum-fibrosus 19wt% fines-like granulated-blastfurnace-slag 80wt% as other examples of this invention, What kneaded 2t of contained roadbeds for 10 minutes with the eye RIHHI mixer is set to sample 2a. cement mixed ore slag 100 wt% which consists of slag 95wt% -- receiving -- water -- 30wt(s)% -- granulated-blastfurnace-slag constituent cement with 10wt(s)% cement mixed ore slag 100 wt% which consists of slag 90wt% -- receiving -- water -- 30wt(s)% -- what kneaded 2t of contained roadbeds for 10 minutes with the eye RIHHI mixer was made into sample 2b.

[0014] After forming these kneaded samples 1a and 1b, sample 2a, and 2b in two cylinder objects with a diameter [of 5cm], and a height of 5cm at a time, being referred to as A and B and performing care of health in the room of the room temperature of 18 degrees C, and 62% of humidity for three days, seven days, and 28 days, the compressive strength trial of a sample is performed and that result is shown in Table 1.

[0015]

[Table 1]

| | | (kg/cm ²) | | | |
|------|-----|-----------------------|--------|------------|--------|
| | | 試料 1 a | 試料 1 b | 試料 2 a | 試料 2 b |
| 養生期間 | 硬化剤 | ポルトランドセメント | | 高炉水砕スラグ組成物 | |
| | | 5wt% | 10wt% | 5wt% | 10wt% |
| 3日 | A | 4.08 | 8.15 | 4.59 | 11.7 |
| | B | 4.08 | 8.92 | 4.33 | 11.7 |
| | 平均 | 4.08 | 8.54 | 4.46 | 11.7 |
| 7日 | A | 4.08 | 10.2 | 7.13 | 18.3 |
| | B | 4.08 | 10.2 | 7.13 | 18.3 |
| | 平均 | 4.08 | 10.2 | 7.13 | 18.3 |
| 28日 | A | 7.64 | 18.8 | 18.9 | 47.9 |
| | B | 9.17 | 20.4 | 19.9 | 50.9 |
| | 平均 | 8.41 | 19.6 | 19.4 | 49.4 |

[0016] Even if it passed for after [kneading] three days by Samples 1a and 1b so that clearly from a table, although reinforcement hardly changed, after progress, its reinforcement increased a little in sample 1b for seven days. And after progress, reinforcement increased Samples 1a and 1b twice [about] on the 28th. Moreover, reinforcement is about 1.6 when 7 day will pass, although reinforcement will not change with sample 2a and 2b in three days after kneading. It became twice and became 4.24 times after progress on the 28th.

[0017] Next, the permeable trial was performed about sample 2a. For the permeable trial, two containers of an iron cylindrical shape with a diameter [of 54cm] and a depth of 85cm were prepared, and water was supplied into each container which poked sample 2a lightly in thickness of 65cm, and hardened sample 2a as well as punning and another side with the rod wooden enough to one side at the thickness of 65cm, maintaining tap water at least at constant water from the upper part, and the water permeate flow discharged from the lower part of a container was measured.

[0018] consequently, the coefficient of permeability of sample 2a when the coefficient of permeability of sample 2a when fully poking and hardening being 6.2×10^{-7} (cm/s), poking lightly, and hardening -- 1×10^{-5} (cm/s) -- it is -- the optimal coefficient of permeability 1×10^{-4} (cm/s) for general tree training -- near -- it agrees for the letter affair of training of a tree enough. Next, the scour sex test of the sample of this invention is described below. First, the test method of scour-proof nature is shown in drawing 1.

[0019] Samples 1a, 1b, and 2a and 2b were poked and hardened in 60 inclinations in height of 60cm, the slope 1 was produced, ***** 2 was formed in height of 70cm from G.L., and the pit 3 with a depth of 25cm was formed below G.L. Next, it was made to flow down the water of the amount of water of the convention from ***** 2 on the 50cm slope 1 of height from G.L.

[0020] The sample which scour was carried out and was deposited in the downward pit 3 with the water which flowed down was dried, and the weight was measured. The test condition and a result are shown in Table 2. In addition, the test result of the milt soil which the conventional example poked as a comparison and was hardened was written together.

[0021]

[Table 2]

| 区 分 | 試料 1 a | 試料 1 b | 試料 2 a | 試料 2 b | 従来例 |
|---------------|--------|--------|--------|--------|-----|
| 流水落下高さ (cm) | 20 | 20 | 20 | 20 | 20 |
| 流水量 (l/min) | 2 | 2 | 2 | 2 | 2 |
| 洗掘量 (g/10min) | 20 | 10 | 10 | 2 | 900 |

[0022] As compared with the conventional example, the scour-proof nature of Samples 1a and 1b and sample 2a, and 2b was far good so that clearly [in this test result]. Moreover, the revegetation sex test of the sample of this invention developed the revegetation ground using a break, Samples 1a and 1b, sample 2a, and 2b for a part of location filled up with the pavement material 4 of drawing 2, planted three kinds of trees, a tree, a lower tree, and a shrub, in each, and performed them to it.

[0023] Although the result of the vegetation sex test was shown in Table 3, the pavement material of this invention showed the outstanding revegetation nature.

[0024]

[Table 3]

| 区 分 | | 試料 1 a | 試料 1 b | 試料 2 a | 試料 2 b |
|---------------------------------|-------------------------------|--------|--------|--------|--------|
| 樹 木 の 育 成 状 態 | 旺盛な成育を示し 成育速やかである | ○ | | | |
| | 正常に育成し、異常 は認められない | | ○ | ○ | ○ |
| | 成育不良で明らかに 異常が認められる | | | | |
| | 殆ど育成せず、枯れ るなど回復の見込み がない | | | | |

[0025] Next, when these pavement material is stocked at the product yard after kneading in the manufacture approach of the pavement material of this invention, In the case of three days after kneading, reinforcement does not change so much, but since it increases to the extent that reinforcement will double after the increase of the reinforcement, and 28 days after progress at the pavement material of granulated-blast-furnace-slag slag cement addition for seven days, it is necessary to unfold the lump of the pavement material after care of health for two to three days, and to side-**** once [at least] or more.

[0026] If the activity is neglected and it is recuperated without horizontal **** exceeding seven days, pavement material will be solidified and digging and grinding will become difficult only with a heavy industrial machine. Next, the pavement material 4 of this invention was used as reinforcing materials of slag pilling yard ***** 5 of drawing 2 , and pilling yard ***** 6, the small swamp bulldozer performed the reinforcing materials's compaction for every m in thickness, and it pressed down and fabricated the slope with the basket of a shovel car for the scour prevention by storm sewage.

[0027] The engineering properties (tightness extent of soil, a kinetic property value, strength property of landfill material, etc.) of the construction object of the one year after and a physical property (specific gravity, moisture content, a liquidus limit, plastic limit) were investigated. No.1 which shows investigation to drawing 2 , and No. -- while performing test boring of standard-penetration-test concomitant use in two places of a point 2 hole and measuring N-ary, by test pit digging, sampling was performed so that the present ***** might not be disturbed, and general physics and a triaxial compression test were carried out using the sample.

[0028] Moreover, the tamping trial was performed using the extracted sample and kinetic property of the pavement material which added cement to slag was clarified. although the standard penetration test was carried out for every depth of 1.0m in the aforementioned test boring -- No.1 hole -- a point -- the depth of 17.7m, and No.2 hole -- a point -- depth of 11.5m up to -- the pavement material 1 was distributed. The N-ary of a measurement location was calculated by this standard penetration test.

[0029] A depth of 1.5m thru/or the N-ary between 2.5m are N= 8-9 from the topmost part. Although ten or less are shown, in the deep location beyond it, N-ary shows ten or more. No.1 hole -- an average of N values of a point -- 14.6 -- No. -- an average of N values of a point are 21.0 2 hole, and the pavement material 1 can increase reinforcement further by the elapsed time after construction, the execution management approach, etc.

[0030] In addition, N-ary and the relation of the hardness of soil are shown in Table 4.

[0031]

[Table 4]

| | 非常に 軟らかい | 軟らかい | 中位の 固さ | 固い | 非常に 固い | 固結した |
|----|-------------|------|-----------|------|-----------|-------|
| N値 | 2以下 | 2～4 | 4～8 | 8～15 | 15～30 | 30 以上 |

[0032] next, No. -- the result of having performed the tamping trial using the sample extracted 1 hole at the point is

shown below.

(1) The specific gravity of a soil particle is 2.69 and is similar to the specific gravity of common soil.

(2) natural water content -- 34.3 - 40.1% it was .

(3) Moisture content of moisture content = 45.7-50% of a liquidus limit (LL), and a plastic limit (PL) = 32.9% (4) The reinforcement C = 10 in a triaxial compression test - 18.7 tf/m² (5) Punning trial Maximum dry density 1.368 t/m³ Optimum moisture content was 29.8%.

[0033] The reinforcement C = 10 in a triaxial compression test - 18.7 tf/m² Since the N-ary of the corresponding foundation is considered to be the about eight to ten foundation, it is assumed that the pavement material of the investigation ground is distributed by the reinforcement beyond this. It is optimum moisture content as a result of a punning trial. Although it is 29.8% and natural water content is 34.3 - 40.1%, since it is not necessary to enlarge N-ary any more at a present stage, it is unnecessary to reduce construction moisture content.

[0034] Although variation has measurement N-ary also between points and in the depth direction, use of the pavement material of this invention is fully possible. In addition, the pavement material of this invention is applicable to a location, for example, the park etc., etc. where a channel is formed at the time of a rainfall, the soil of the Hydrographic Department is flushed also in the flat ground, and scour of the soil of the surface section is carried out in addition to a steep slope side or a slope:

[0035]

[Effect of the Invention] As explained above, by constructing the pavement material of this invention to the slope of an inclination wall etc., there is also no outflow of the pavement material by storm sewage, the face shield of the slope of an inclination wall etc. is built with sufficient reinforcement, moreover revegetation becomes possible, and protection and tree planting of an inclination wall etc. can fully attain.

[0036] Moreover, also in the flat ground, it is lost by constructing the pavement material of this invention that the soil of the front face of the flat ground is flushed with storm sewage.

[Translation done.]

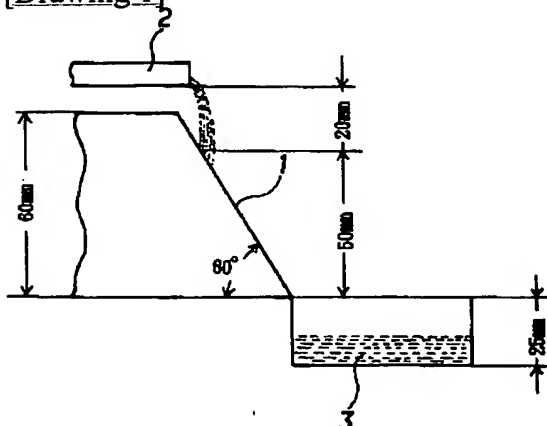
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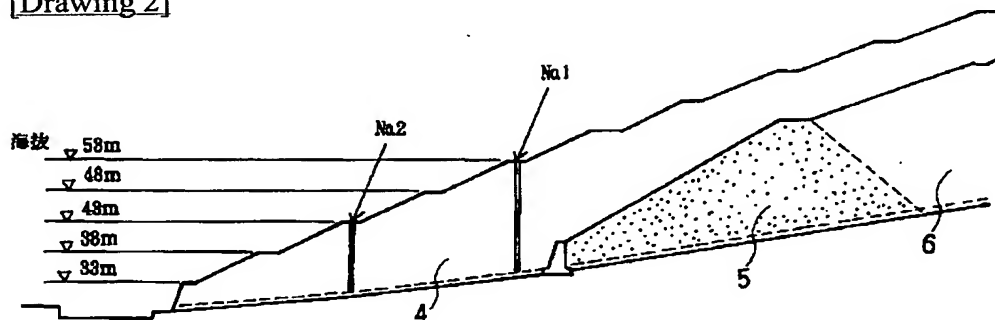
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DRAWINGS

[Drawing 1]



[Drawing 2]



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